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# Distributional records for *Loxopholis rugiceps* Cope, 1869 (Squamata, Gymnophthalmidae) in Central America

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**Abstract**
Only 2 lizard species of the 11 members of the genus *Loxopholis* Cope, 1869 are found in Central America, *L. southi* (Ruthven & Gaige, 1924) from Costa Rica to Colombia and *L. rugiceps* Cope, 1869 from Panama and Colombia. We report new country records for *L. rugiceps* from Honduras and Costa Rica. We collected 4 individuals of this species in Honduras in 2018 and 2 specimens in Costa Rica in 1997 and 2017. We discuss the distribution of *L. rugiceps* in Central America.

**Key words**
Costa Rica, Departamento de Cortés, Honduras, *Loxopholis southi*, Mesoamerica.

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## Introduction

The family Gymnophthalmidae currently is known to contain 257 species (Uetz 2019) of small to medium-sized lizards, which inhabit several habitat types in Central and South America (Vitt and Caldwell 2009, Meza-Joya and Ramos-Pallares 2015). Gymnophthalmid lizards of the genus *Loxopholis* Cope 1869 are small (snout–vent length <50 mm) species but form an important component of the leaf-litter herpetofauna of Neotropical forests (Dixon and Soini 1986, Rodrigues et al. 2002). This genus primarily is South American in distribution, as among the 11 currently recognized species, only 2 are known to occur in Lower Central America (Köhler 2008, Uetz 2019), *Loxopholis southi* Ruthven & Gaige, 1924 and *Loxopholis rugiceps* Cope, 1869.

*Loxopholis rugiceps* was described from the "Magdalena River region, Nueva Granada" in Colombia (Cope 1869: 305). Ruibal (1952) included Cope's genus *Loxopholis* in *Leposoma* Spix, 1825 (Goicoechea et al. 2016). *Loxopholis rugiceps* has been reported from Panama and Colombia (Köhler 2008, Uetz 2019), with the province of Bocas del Toro in extreme western Panama as the northernmost point of distribution (Lotzkat et al. 2012).

Wilson et al. (2010) provided an extensive summary of the Mesoamerican herpetofauna, and since that time, several important contributions from throughout this region have been published. In Honduras, McCranie (2018) provided an extensive list of bibliographical references for much of the work that has been conducted in that country and highlighted the available knowledge

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on its reptile fauna. Unfortunately, much of the original habitat in Honduras has been lost (Mora et al. 2018, McCranie 2018) at a time when there is still much to learn about reptiles of that country. Accordingly, even such simple contributions as new localities for various reptile species are valuable. The same also is true for Costa Rica, as well for other countries in Mesoamerica. Nonetheless, some reports of species found in new localities are limited to the report itself, and additional information is necessary to help understand the reasons why certain species are being reported from new locations. For example, Espinal and Mora (2019) not only reported a new locality for *Mesoscincus managuae* (Dunn, 1933) on the Caribbean versant of Honduras, a largely Pacific coastal lowland dry forest species, but also provided an ecological and biogeographical explanation for this find.

The current literature is replete with reports of new localities for species of numerous taxa. Among other possibilities, these reports show at least 2 aspects of great importance: dispersal movements of several species due to various factors (Mora and López 2011) and a lack of information on the natural history of the species, including such basic data as their distributional ranges. Of course, linked to their distribution are aspects related to negative impacts, survival, and adaptation that we do not fully understand (Espinal and Mora 2019).

Information on the geographic distribution of gymnophthalmid lizards remains incomplete mainly because many species are fossorial or semi-fossorial in their habits (Meza-Joya and Ramos-Pallares 2015) and because inventories of lizard faunas in areas within distributional ranges of these species are scarce, and thus, extensive field research is necessary (Arbeláez-Cortés 2013). Our objective is to document new localities in Honduras and Costa Rica for a gymnophthalmid species known only from South America and southern Central America; this species' northernmost distribution limit was previously documented in the province of Bocas del Toro, Panama (Lotzkat et al. 2012).

## Methods

We conducted herpetofaunal surveys in the Departamento de Cortés in northern Honduras in 2018, and collected 4 individuals of *Loxopholis rugiceps* at 2 localities (Fig. 1). We photographed the lizards, and later preserved them using standard procedures for fluid preservation (Pisani 1973). Specimens were deposited in the Museo de Zoología at the University of Costa Rica (UCR), and in the Museo de Historia Natural UNAH-VS Biodiversidad y Ciencia, San Pedro Sula, Honduras (UVS-V). The collecting permit (DE-ICF-065-2018) was provided by the Instituto de Conservación Forestal (ICF), Tegucigalpa, Honduras. Occurrence data for *L. rugiceps* were obtained from the literature (Ruibal 1952, Dixon and Soini 1986, Hernández et al. 2001, Köhler 2008, Lotzkat et al. 2012, Meza-Joya and Ramos-Pallarez 2015, McCranie 2018, Uetz 2019).

Abbreviations used: SVL = snout–vent length; TL = tail length.

## Results

**New records.** HONDURAS: Cortés: La Venta, Pimienta (15°15′04″ N, 088°00′04″ W; 50 m alt.), collected by Mario R. Espinal, 27 October 2018, crossing a gravel road along a sugarcane field near the Rio Ulúa (Fig. 3A) at 1000h (1 male, UCR 23181, SVL = 37 mm, TL = 76. Cortés: Caracol, Potrerillos (15°09′15″ N, 087°56′59″ W; 65 m alt.), collected by Mario R. Espinal, 27 November 2018, in leaf litter and debris along the roots of a *Ficus* sp. tree (Fig. 3B) at 1100h (1 female, UVS-V-01232, SVL = 38, TL = 72). Cortés: Caracol, Potrerillos (15°09′15″ N, 087°56′59″ W; 65 m alt.), collected by Mario R. Espinal, 28 November 2018, in leaf litter within secondary vegetation (Fig. 3C) at 1100h (1 female, UVS-V-01233, SVL = 36, TL = 87). Cortés: Caracol, Potrerillos (15°09′15″ N, 087°56′59″ W; 65 m alt.), collected by Mario R. Espinal, 15 December 2018 in leaf litter within secondary vegetation (Fig. 3D) at 1730 h (1 male, UVS-V-01234, SVL = 32, TL = 68 mm).

**Other specimens examined.** While examining and comparing the first specimen collected, we discovered 2 specimens of *L. rugiceps* that previously had been identified as *L. southi*.

COSTA RICA: Limón: Talamanca, Sixaola, San Miguel (09°34′19″ N, 082°40′50″ W; 35 m alt.), collected by Gerardo Chaves, 28 January 1997 (1 female, UCR 12967). Limón: Talamanca, Sixaola, Manzanillo (09°38′15″ N, 082°38′45″ W; 25), collected by Jairo Moya Ramírez, 14 May 2017 (1 male, UCR 22983).

**Identification.** Initially, Larry David Wilson identified the species, and we later confirmed its identity by conducting a review of the pertinent literature (Ruibal 1952, Rodrigues 1997, Rodrigues et al. 2002, Goicoechea et al. 2016) and by examining specimens in the UCR collection and conducting a morphological analysis. We used keys to separate and identify *L. southi* and the Honduras specimens.

The Honduran specimens were identified as *Loxopholis rugiceps* by the presence of 1 frontonasal instead of 2, as in *L. southi*. The scale counts for UCR 23181 are as follows: transverse dorsal rows 21, transverse ventral rows 23, gulars 10, and number of scales from parietals to posterior margin of hind limbs 27. The scales in *L. rugiceps* are keeled on the side of neck and are imbricate and shaped like the dorsals, and the prefrontals are in contact medially and are slightly smaller than the frontoparietals (Ruibal 1952). The temporals are large and keeled, and a single anterior postmental is present, which is followed by 2 pairs of postmentals that are in contact medially. Longitudinal rows of enlarged gulars are absent in this species. The scales on the limbs are keeled, except for on the posterior surface of the hind limbs, the subcaudals are elongate, keeled, and arranged in longitudinal

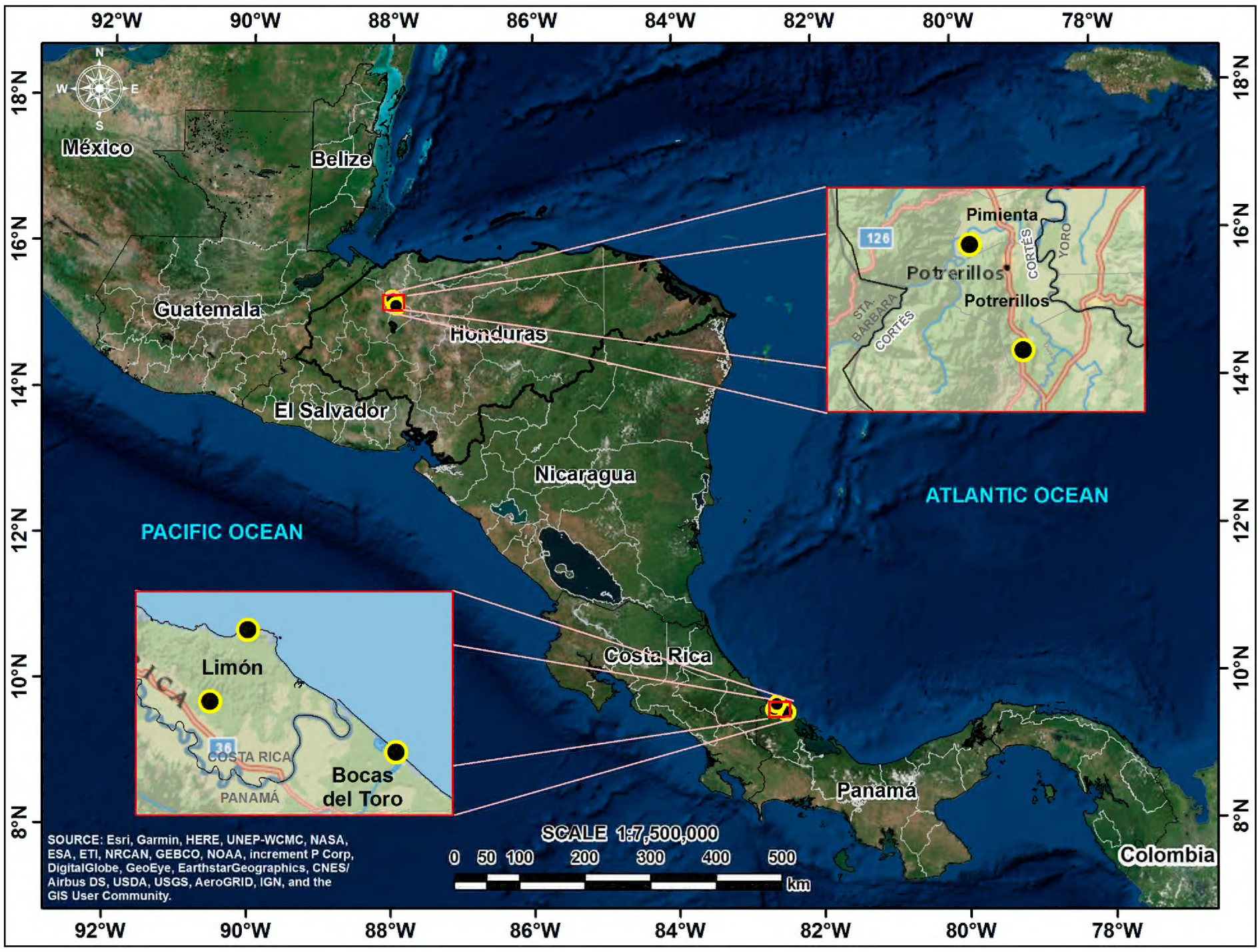


**Figure 1.** Localities of new records (black dots) for *Loxopholis rugiceps* in Departamento de Cortés, Honduras, and Limón, Costa Rica, and the northernmost known locality for this species in Bocas del Toro, Panamá.

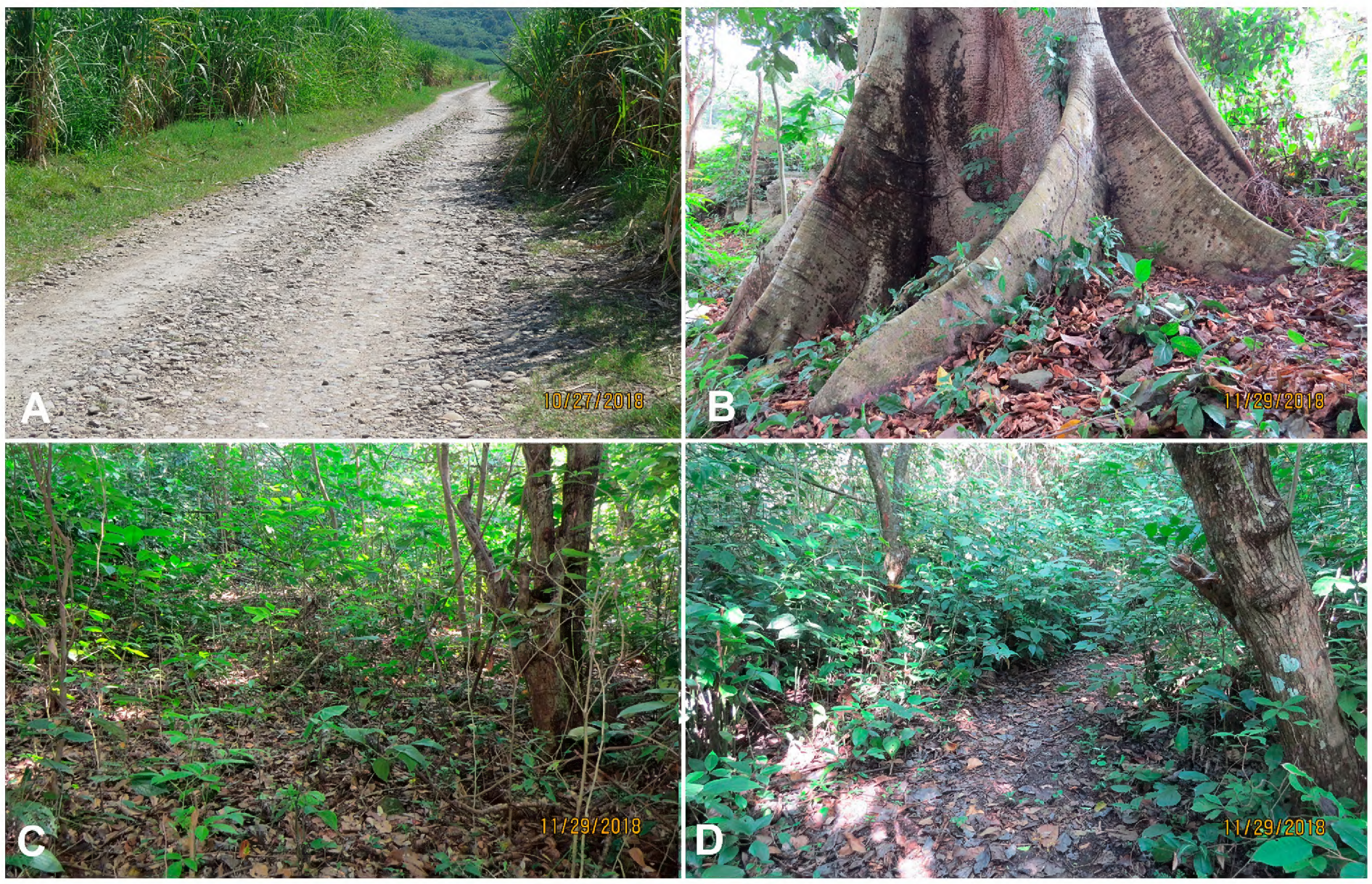


**Figure 2.** Collecting points for 4 individuals of *Loxopholis rugiceps* in the Departamento de Cortés, Honduras.. **A.** Male UCR 23181. **B.** Female UVS-V-01232. **C.** Female UVS-V-01233. **D.** Female UVS-V-01234.

**Figure 3.** An individual of *Loxopholis rugiceps* (UVS-V-01232, Departamento de Cortés, Honduras) showing all the characteristics that separate this species from others in the genus.

and transverse rows, and the caudals are broad, keeled, and only form longitudinal rows on the last two-thirds of the tail (Ruibal 1952). The dorsum of our specimens is brown with the lateral surfaces dark brown or black, and with the tip of the scales white. The side of the neck is similar in color to the sides of the body in this species, but also includes diagonal rows of white scales. The dorsum is slightly paler than the top of the head (Ruibal 1952). Our specimens from Departamento Cortés agree well with this description, and contain all the key characteristics mentioned therein (Fig. 3).

## Discussion

As currently understood, the gymnophthalmid genus *Loxopholis* Cope 1869 contains 11 species of small, leaf-litter-dwelling lizards that occur in Neotropical forests in Central and South America (Pellegrino et al. 2011, Uetz 2019). These lizards occur exclusively in tropical forested areas and previously were known from Costa Rica to the Atlantic slopes of eastern Brazil (Rodrigues 1997). Only 2 species have been reported in Central America: *L. southi* from Costa Rica to Colombia and *L. rugiceps* from the province of Bocas del Toro, Panama to Santa Marta and Valle de Rio Magdalena in Colombia (Rodrigues 1997).

Because these species prefer cryptic microhabitats (leaf litter, caves, roots, and fallen trunks), they are often difficult to observe (Hernández et al. 2001). The secretive habits of species of *Loxopholis* might explain why *L. rugiceps* had not been previously reported from Honduras. Still, given the abundance of *L. rugiceps* in the study area, we find it surprising that this species had gone unnoticed. A possibility is that most herpetologists conduct their research in protected areas or pristine habitats and not in the disturbed areas that are now more extensive.

It would seem logical that *L. rugiceps* should be present in the intervening area, namely along the Caribbean lowlands of Nicaragua and most of Costa Rica. We can only surmise that within this distributional gap *L. rugiceps* is absent or present but not collected, or present and collected but misidentified as *L. southi*. The last supposition has proved to be the case, as we can confirm that 2 specimens, collected previously but misidentified, have been found in the Caribbean lowlands of Costa Rica. These specimens help fill the distributional gap and provide a better understanding of the total distributional range of *L. rugiceps*.

Assuming that the Honduras population is autochthonous, the possibility that *L. rugiceps* is absent in this distributional gap seems highly unlikely, given the presence of suitable habitat throughout most, if not all, of the intervening region, and the 2 Costa Rican specimens support this supposition. Nonetheless, we cannot rule out that the population of *L. rugiceps* found in Honduras might have been introduced, as a specimen was reported to have reached the United States in a shipment of bananas from Panama (Lotzkat et al. 2012).

An explanation as to how *L. rugiceps* turned up in Honduras remains an enigma. Ancient temporal diversification (pre-Pleistocene) of Neotropical fauna often

has been reported for several lizards and snakes (Pellegrino et al. 2011). Thus, a Pliocene colonization of Central America by *L. southi* during the rise of the Isthmus of Panama is possible (Pellegrino et al. 2011), and this occurrence might also explain the distribution of *L. rugiceps*. These patterns of diversification might be related to different major climatic variations associated with marine transgressions, geotectonic processes, and river dynamics, and a single model of vicariance or climatic changes does not reflect the complexity of speciation in the Neotropics (Pellegrino et al. 2011).

Unfortunately, the combination of habitat loss and global climate change are causing a rearrangement of the faunas, which will lead to unpredictable consequences on their ecosystems, their functioning, and, above all, on the services and goods that human beings will obtain from them (Mora and López 2011). The redistribution of life on Earth has emerged as one of the most biologically significant responses to anthropogenic global warming (Sunday et al. 2012). Several species already are experiencing changes in distribution, primarily related to elevation, as a result of changes in temperatures (Hannah et al. 2007). Apparently, distributional changes related to an increase in deforested areas used by generalist species also are occurring (Mora and López 2011). Presently, we are not aware if the ancestral and recent distributions of *L. rugiceps* in Central America are related to any of these causes, but we pose the question here.

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## Authors' Contributions

JMM wrote the manuscript and helped to manage all information; MRE collected the Honduras specimens, collected the data and took the photographs; GC identified the specimens and provided the data of the Costa Rica specimens; LIL helped to develop the manuscript and provided and analyzed literature. All authors read, edited, and approved the manuscript.

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